Journal of Cardiology Cases (2012) 5, e133–e136

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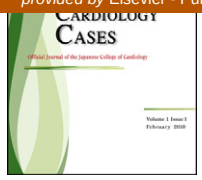

Case Report

The usefulness of an intravascular ultrasound in the diagnosis of left main coronary artery dissection

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Received 13 September 2011; received in revised form 3 January 2012; accepted 9 February 2012

KEYWORDS
Type A aortic dissection;
Left main coronary artery;
Intravascular ultrasound

Summary Acute type A aortic dissection occasionally involves coronary orifice which may lead to fatal myocardial infarction. We present a case with acute type A aortic dissection developing transient hemodynamic collapsing despite emergent surgical ascending aortic repair. Electrocardiogram after successful cardiopulmonary resuscitation suggested myocardial ischemia. Subsequent selective catheter coronary angiography conducted under percutaneous cardiopulmonary support system did not demonstrate the coronary dissection, but intravascular ultrasound (IVUS) clearly revealed the intimal flap and medial hematoma caused by dissection at left main coronary artery (LMCA). We performed stent implantation at LMCA as a bail-out procedure, and she was discharged after uneventful clinical course. IVUS was useful in this case for the precise diagnosis and making therapeutic strategy for dissection extending to LMCA.

Introduction

Acute type A aortic dissection occasionally extends to the orifice of coronary artery and causes coronary malperfusion which leads to fatal myocardial infarction. Coronary angiography and percutaneous coronary intervention (PCI) in such a complicated case is controversial with only limited data. Intravascular ultrasound (IVUS) used in PCI often provides crucial information for diagnosis and treatment which may not be detected by coronary angiography.

Case report

A 65-year-old woman with a history of hypertension was referred to our institution for severe back pain. Chest enhanced computed tomography revealed type A aortic dissection and she underwent emergent surgical hemiarch replacement. Two hours after coming back to the intensive care unit, her blood pressure suddenly fell. The electrocardiogram just after prompt and successful cardiopulmonary resuscitation showed marked ST-segment depression in precordial leads which suggested myocardial ischemia (Fig. 1). She returned to the operating room for open chest evaluation of the cause of hemodynamic collapsing and for conducting hemodynamic support. However, she had no finding of mediastinum bleeding,

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1878-5409/$ – see front matter
doi:10.1016/j.jccase.2012.02.004

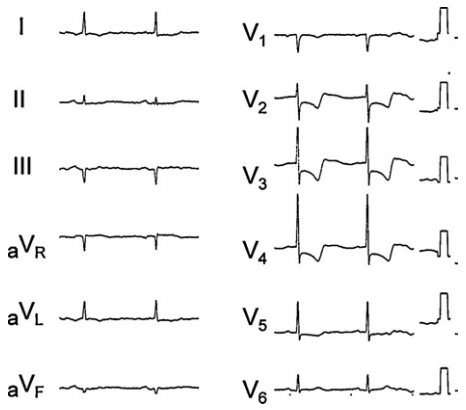

Figure 1 Electrocardiogram just after successful cardiopulmonary resuscitation showed ST-segment changes which suggested left coronary malperfusion.

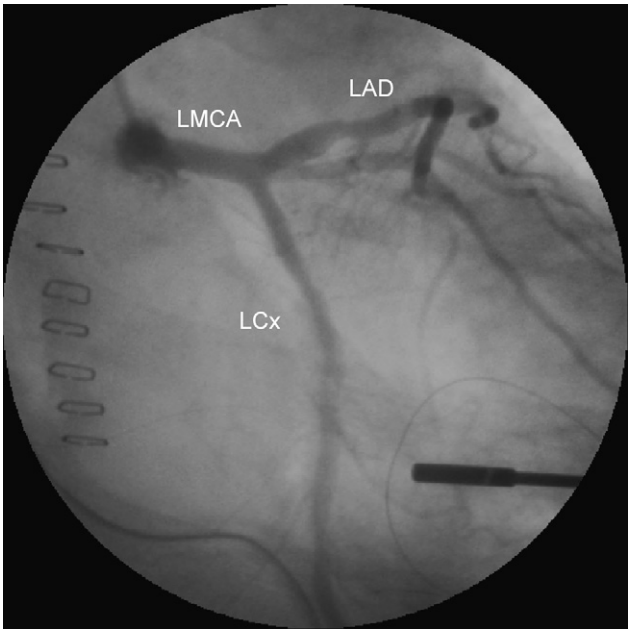

Figure 2 Selective left coronary angiography using catheter could not prove the findings of stenosis or dissection at left main coronary artery. LAD, left anterior descending artery; LCX, left circumflex artery; LMCA, left main coronary artery.

cardiac tamponade, or aortic valve dysfunction. Transesophageal echocardiogram during open chest evaluation provided equivocal and blurred images of dissection in the left main coronary artery (LMCA), and the image and the range of dissection were not definitive. Then percutaneous cardiopulmonary support system (PCPS) was operated due to prior hemodynamic instability, and the hemodynamic stability was maintained without significant ischemic changes in electrocardiogram. Because of an episode of transient hemodynamic collapsing with prior evident electrocardiographic ischemic changes and a history of hypertension which was one of the coronary risk factors, emergent cardiac catheterization under PCPS was carefully performed to evaluate the precise coronary morphology and to make a therapeutic strategy for the possible extended dissection to the left coronary artery.

Ascending aortography and selective left coronary angiography using catheters could not prove any significant stenotic or pulsatile lesion (Fig. 2). However, intravascular ultrasound (IVUS) clearly revealed the intimal flap and medial hematoma due to extended aortic dissection limited to the middle portion of the LMCA (Fig. 3). As a bail-out procedure, a bare metal stent was successfully implanted and was cautiously expanded in the LMCA, then optimal stent apposition was obtained. After the procedure, her hemodynamic stability was maintained, and she was withdrawn from PCPS and was discharged later. The stent apposition and the lumen of the LMCA at one year after deployment, demonstrated by multi-detector row computed tomography, were favorable (Fig. 4).

In this case, selective coronary angiography could not prove the pathogenesis because contrast agent injection might have expanded or kept the true lumen at the time of angiography, which may have given us the false impression that there was no stenosis or no occlusion. Therefore, IVUS was necessary for the correct diagnosis in this case.

Discussion

We confirmed the pathogenesis of the present case by IVUS rather than catheter angiography as a coronary malperfusion due to type A dissection extending to the LMCA, and successfully treated the patient with bare metal stent deployment to the LMCA as a bail-out procedure.

Type A aortic dissection occasionally involves coronary orifice and causes extensive myocardial infarction which rapidly deteriorates the hemodynamics and is often fatal. The incidence of acute myocardial ischemia due to the extension of aortic dissection among dissection patients has been reported as 5.7—11.3% according to previous clinical reports [1,2], and 7% in autopsy [3]. The incidence in our institution was 6.1% (12 of overall 196 dissection patients) and the mortality was 33.3% (4 of 12) [4]. Neri et al. described the mechanism of coronary malperfusion caused by aortic dissection, and classified the condition in terms of surgical treatment into three types based on the morphology of the dissection [2]. We considered the pathogenesis of the present case as a primary dissection extending to the LMCA or progression of dissection due to surgical aortic repair rather than a pure surgical complication because electrocardiogram on hospital arrival showed slightly but retrospectively reversible ST-T segment changes.

Undertaking coronary angiography in a patient complicated with acute type A aortic dissection remains controversial in terms of balancing between risk and benefit. Furthermore, coronary angiography in such a patient is complex and time consuming because of difficult access, and may increase the risks of aortic rupture, cardiac tamponade, and the progression of aortic dissection [5,6]. Because previous reports concerning successful catheter coronary revascularization are limited compared with more reports about surgical coronary bypassing concomitant with aortic repair, the efficacy and long-term clinical results of catheter revascularization have not been well established. In the present case, we decided to conduct a cardiac catheterization because of possible extended dissection and comparative safety with preceding PCPS and ascending aortic replacement. In catheter engagement to the left coronary orifice, transcatheter arterial blood pressure did not show wedge-like wave form, and coronary angiogram did not demonstrate pulsatile change in vessel diameter which is often reported in similar dissections. In the present case, we thought the latter might be associated with fixation of false lumen after surgical repair of aortic root.

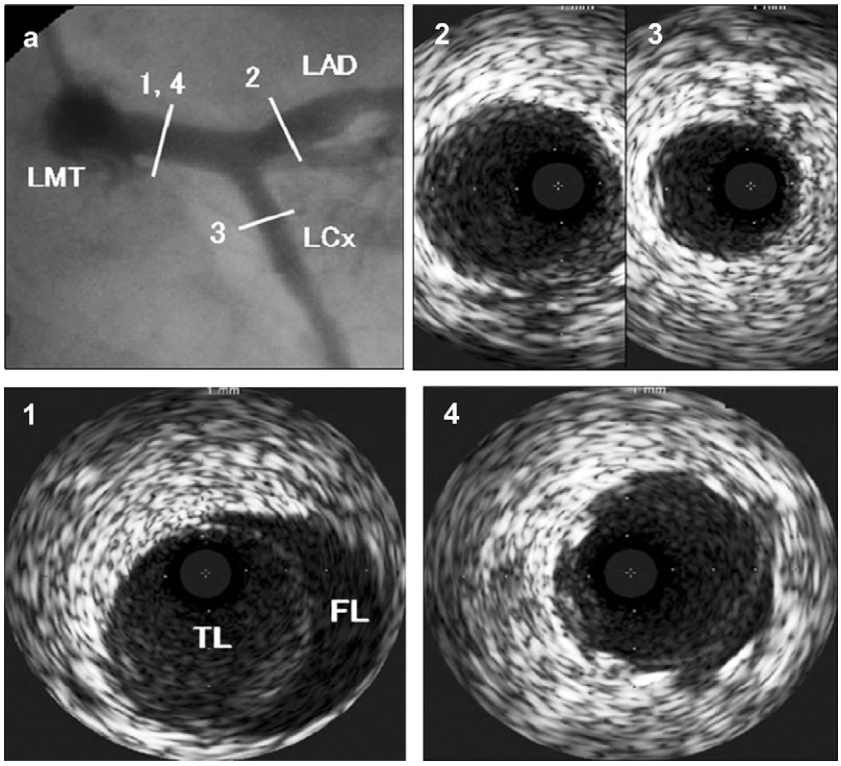

Figure 3 Image of left coronary angiography from right caudal view (a) and images of intravascular ultrasound (IVUS) at left coronary artery (1—4). IVUS revealed aortic dissection extending to left main coronary artery (1). Stent was deployed to the ostium to body of left main coronary artery (4). LAD, left anterior descending artery; LCX, left circumflex artery; LMT, left main trunk; FL, false lumen; TL, true lumen.

Importantly, selective catheter angiography in such cases may mask the important finding of coronary artery ostium compressed by false lumen because once the catheter correctly engages in the true lumen, the catheter itself and contrast agent injection may expand or keep the true lumen, which may easily lead to a false diagnosis. Thus, other imaging modalities including IVUS should be taken into consideration in such a case.

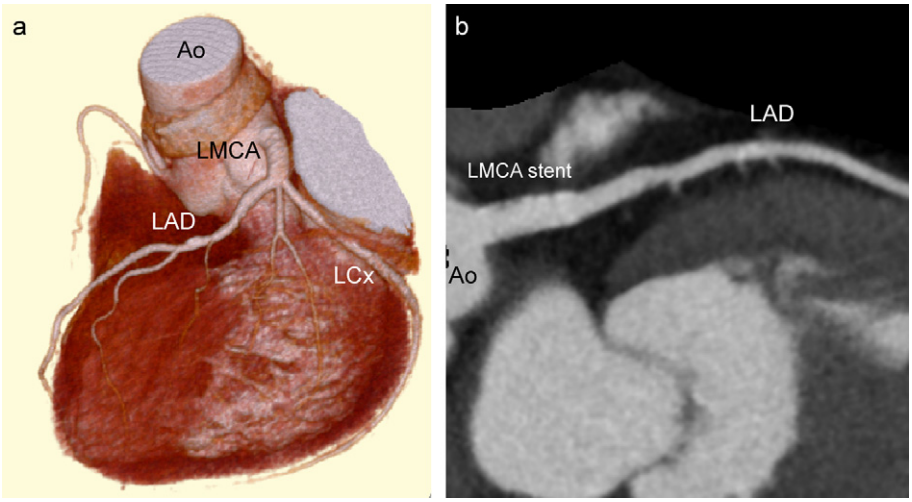

Figure 4 Images of multi-slice detector row computed tomography angiography at left coronary artery. (a) Volume rendered image; (b) multiplanar reconstruction image. Both images showed optimal stent apposition and no significant intimal hyperplasia in left main coronary artery at one year. Ao, aorta; LAD, left anterior descending artery; LCX, left circumflex artery; LMCA, left main coronary artery.

Acknowledgment

K. Arao and R. Naito equally contributed to this work.

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